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PROCESS FOR THE PREPARATION OF DISPERSIONS OF SOOT IN RUBBER

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The invention pertains to the mixing together of rubber and soot and provides an improved process for combining soot and natural or synthetic rubber or other polymeric substances.

Serious attempts have been made for many years by industry to develop an effective and industrially usable process for dispersing soot in rubber by mixing together the soot with the rubber latex prior to the coagulation of the rubber but, as far as is known, the current processes--even if they are capable of operation--leave much to be desired.

In accordance with one known process, soot is stirred in dry form in a large vessel that contains water, a dispersing agent, and a stabilizing agent to form a stable suspension of soot; this is adjusted to the pH value of the latex by means of the addition of caustic soda. The soot suspension is prepared in large individual batches in accordance with this and is then mixed with a pre-determined quantity of latex. An emulsifying agent, e.g. a salt, is then added and, after achieving emulsification, a coagulating agent, e.g., sulfuric acid or alum, is added. The coagulate produced is separated from the skim and dried. This process essentially signifies batchwise or discontinuous working.

In this connection, a significant part of the soot remains in the skim. Difficulties are also observed during the further processing of the rubber and the properties of the finished rubber product are generally bad.

In order to maintain a uniform dispersion of the soot and in order to regulate the quantity of soot added to the latex and to avoid excessive viscosity of the aqueous soot suspension during storage and processing, attempts have been made to avoid the use of the dispersing agent, though these are necessary in practical operations.

Additional and similar processes also provide treatment vessels for the preparation of the soot dispersion as well as the further dispersion of the soot and latex. One is not dealing with fully continuous processes in any of these cases. In addition, the danger of settling out in the vessels always exists, so that the exact regulation of the ratio of soot to rubber is rendered difficult.

An objective of the present invention is to create a continuous process for combining soot with rubber or similar materials in which the use of dispersing agents, the grinding together of the soot to give an aqueous dispersion, and other disadvantageous characteristics of the current mode of working (vessels) can be completely avoided.

In accordance with the present process, the soot, especially furnace soot, is continuously mixed, in a uniform predetermined quantity, with a uniformly flowing stream of water under intense conditions of impacting so that, as a result, a continuously flowing delineated stream of an aqueous soot suspension with a uniform composition is formed. This suspension is immediately mixed, in the turbulent state, with a stream of latex in a uniform pre-determined quantity under intense impacting conditions and stirring is continued until coagulation sets in.

The process has the advantage of a continuous and uniform mode of working and avoids mixing containers and storage containers for the suspension of the soot that is initially prepared. It avoids the costs and the injurious effects of dispersing agents and stabilizing agents as well as the necessity of grinding the soot.

The process is usable with all types of soot whether they are granular or whether they are to be found in the form of flakes. It is also usable for combining soot both with synthetic or natural

rubber and other polymeric substances that are available in latex form.

The process is of special benefit when mixing together soot with synthetic SR-G rubber and, in particular, that in which the polymerization of butadiene and styrene takes place at low temperatures, i.e., when mixing with so-called low-temperature polymers or "cold rubber."

The hydraulic impacting action is advantageously brought about via the introduction of the soot into the system, with impacting, together with a stream of water at a high velocity or with a jet of water or both. An alternative process comprises initially dispersing the soot coarsely in water, then subjecting the mixture to vigorous impacting with a jet of steam. Mixing together of the generated aqueous soot dispersion with the latex is preferably brought about either by vigorous impacting of the stream of the soot suspension with a stream of latex or by the vigorous mechanical stirring together of the two streams.

For example, a steam-jet blower is advantageously used for the preparation of the soot dispersion. The stream of soot is then fed to a second steam-jet blower in which the stream of latex is the energy-supplying liquid so that the soot is mixed continuously, immediately, and uniformly with the latex. The processes of emulsification, coagulation, washing, and drying then take place.

In accordance with another form of embodiment, mechanical devices are used in order to produce a turbulent stream of water of high velocity into which the soot is continuously introduced in dry form where it is subdivided, dispersed, and suspended via the impacting action of the velocity and turbulence of the stream of water. The soot dispersion is then mixed directly with a high-velocity stream of latex as a result of which one essentially

brings about the immediate and uniform mixing together of the two streams. In the same way, the processes of emulsification, coagulation, washing, and drying then follow.

In all these processes, the mode of operation is continuous and the quantities of soot, which are mixed with the rubber, are easily regulated. Storage containers for the soot dispersion become superfluous and one completely avoids the danger of poor uniformity of the soot fractions in the finished product, e.g., that due to deposition phenomena. After adjusting the measurement devices to the desired quantities of the various fractions, the process can be carried out continuously with a minimum extent of maintenance by the operators. In addition, the invention has the advantage of lower costs and a simple device with the least demand for space.

The quantities of soot used can vary to the usual extent when it is used as a strengthening agent upon mixing into rubber or similar materials, e.g., from 30 to 70 or more parts of dry soot per 100 parts of solid rubber materials.

Special adjustment of the pH value of the soot dispersion is completely avoided. Moreover, the addition of a salt or other emulsifying agents is unnecessary and the quantity of acid or other coagulation agent is significantly reduced. In addition, virtually all the added soot is taken up by the coagulated polymer and a virtually clear skim is obtained. Thus, significant losses of soot are avoided.

The rubber mixtures, especially car tire mixtures for whose manufacture the soot has been dispersed in the rubber as described here, also exhibit a greater rate of vulcanization, a higher modulus, and better tensile properties than those which are prepared using the conventional process.

Claims

1. Process for the preparation of dispersions of soot in rubber in which the soot is mixed with the rubber in latex form and in which the mixture comprising the soot and the latex is then coagulated, characterized by the feature that the soot is continuously mixed, in a uniform predetermined quantity, with a uniformly flowing stream of water using intense impacting action so that, as a result, a continuously flowing delineated stream of an aqueous soot suspension with a uniform composition is formed, with this stream of suspension being immediately and uniformly mixed, in the turbulent state, with a stream of latex in a uniform predetermined quantity with strong impacting action and with stirring being continued until coagulation sets in.
2. Process in accordance with Claim 1, characterized by the feature that the mixing together of the aqueous soot suspension and the latex is brought about by the vigorous mutual impacting of the two streams.
3. Process in accordance with Claim 1, characterized by the feature that furnace soot is used as the soot.
4. Process in accordance with Claim 3, characterized by the feature that a latex comprising synthetic rubber is used as the latex.
5. Process in accordance with Claim 4, characterized by the feature that a mixed polymer comprising butadiene and styrene is used as the latex.
6. Process in accordance with Claim 5, characterized by the feature that a cold rubber is used as the latex.

Documents considered:

German Patent No. 680,110;

U.K. Patent No. 365,564;

French Patent No. 946,482;

U.S. Patent No. 1,611,278;

Extracts of German Patent Applications, Vol. 8, page 256; report concerning Patent Application I 64326 IVc/39b